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Osmia (*Melanosmia*) *steinmanni* sp. n., a new bee species from the Swiss Alps (Hymenoptera, Apoidea, Megachilidae)

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***Osmia* (*Melanosmia*) *steinmanni* sp. n., a new bee species from the Swiss Alps (Hymenoptera, Apoidea, Megachilidae).** - *Osmia* (*Melanosmia*) *steinmanni* sp. n. is described, illustrated and compared to other European species of the subgenus *Melanosmia*. It is morphologically most closely related to *O. svenssoni* Tkalců, 1983 hitherto recorded only from northern Sweden. *O. steinmanni* is known from two localities in eastern Switzerland situated in the subalpine and alpine zone of the Alps. It was found on stony slopes exposed to the south-east. Known pollen sources are *Hippocrepis comosa* and *Lotus corniculatus* (both Fabaceae).

Key-words: Megachilidae - *Osmia* - *Melanosmia* - taxonomy - new species - Switzerland.

INTRODUCTION

Within the scope of the preparatory work for the fourth volume of the Swiss bee fauna (Amiet *et al.*, in preparation) seven ♀♀ of an unknown *Osmia* species (Hymenoptera, Apoidea, Megachilidae) were found in the entomological collections of the ETH Zürich and of the University of Zürich. All specimens had been collected at the Ebenalp (1500 m above sea level) situated in the Alpstein massif in eastern Switzerland on 10th June 1907. An excursion to the Ebenalp nearly one century later, on 1st June 2002, resulted in the discovery of several ♀♀ and of one ♂ of this enigmatic *Osmia*. The inspection of all museum and private bee collections in Switzerland revealed one further ♂ which had also been collected in the Swiss Alps near Juf (Avers, Graubünden, 2300 m above sea level) on 19th June 1994.

On closer morphological inspection these specimens turned out to belong to a hitherto unknown bee species. *Osmia steinmanni* sp. n. is a typical representative of the Holarctic subgenus *Melanosmia* Schmiedeknecht, 1885. In the Nearctic region *Melanosmia* is the major subgenus of *Osmia* with 91 described species (Hurd, 1979; Michener, 2000). Seventeen species are known in the Palaearctic (Zanden, 1988), ten species occur in Europe (Tkalců, 1983).

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SYSTEMATIC PART

Osmia (Melanosmia) steinmanni sp. n. Figs 1-7

MATERIAL

Holotype: ♀, Switzerland, Appenzell Innerrhoden, Wasserauen, Ebenalp, 749/238, 1500 m, 1.6.2002, leg. Felix Amiet, coll. ETH Zürich.

Paratypes: 5♀♀, 1♂, same locality and date as holotype, leg. Felix Amiet, Mike Herrmann and Andreas Müller, coll. ETH Zürich (1♀, 1♂), coll. Muséum d'histoire naturelle Genève (1♀), coll. Felix Amiet (1♀), coll. Mike Herrmann (1♀) and coll. Andreas Müller (1♀); 7♀♀, same locality as holotype, 10.6.1907, coll. ETH Zürich; 1♂, Switzerland, Graubünden, Juf-Stallerberg, 2300 m, 19.6.1994, leg. Bernhard Merz, coll. Felix Amiet.

ETYMOLOGY

The new species is dedicated to the excellent bee specialist Dr Erwin Steinmann (Chur) who is as fond of the mountains as "his" bee seems to be.

DIAGNOSIS

O. steinmanni sp. n. belongs to the subgenus *Melanosmia* Schmiedeknecht, 1885 described in detail by Tkalců (1983). In both sexes it is morphologically most similar to *O. svenssoni* Tkalců, 1983 hitherto known only from northern Sweden (Tkalců, 1983), the ♀ can easily be confounded with *O. inermis* (Zetterstedt, 1838) as well (see below).

The diagnosis is given in the form of keys and tables. The keys including all European *Melanosmia* species except *O. bulgarica* Friese, 1922 (see discussion) lead to *O. steinmanni* and its morphologically most similar relatives which are then compared in tabular form. The morphological terminology follows Michener *et al.* (1994).

The opinion that *O. svenssoni* and *O. uncinata* Gerstäcker, 1869 are synonymous (Schwarz *et al.*, 1996) is not followed here. The examination of the type specimens of *O. svenssoni* corroborates the view of Tkalců (1983) that *O. svenssoni* and *O. uncinata* are valid species morphologically clearly separated from each other.

Female

1 Propodeum shiny, propodeal triangle nearly completely polished or at least along sides with shiny area. Body length at least 11 mm. *Osmia alticola* Benoist, 1922; *Osmia maritima* Friese, 1885; *Osmia xanthomelana* (Kirby, 1802). See Tkalců (1983) and Haeseler (1999) for distinctive characters.

1* Propodeum and propodeal triangle completely shagreened and dull. Body length at most 10 mm 2

2 Declining basal portion of first tergite shiny, at most superficially shagreened here and there. *Osmia hyperborea* Tkalců, 1983; *Osmia parietina* Curtis, 1828; *Osmia pilicornis* Smith, 1846; *Osmia uncinata* Gerstäcker, 1869. See Tkalců (1983) and Haeseler (1999) for distinctive characters.

2* Declining basal portion of first tergite densely shagreened, only with silky lustre. *Osmia inermis* (Zetterstedt, 1838); *Osmia svenssoni* Tkalců, 1983; *Osmia steinmanni* sp. n.. See Tab. 1 for distinctive characters.

TABLE 1: Distinctive characters of ♀ of *Osmia steinmanni* sp. n., *Osmia svenssoni* Tkalců, 1983 and *Osmia inermis* (Zetterstedt, 1838).

Osmia steinmanni sp. n. (n = 13)	***Osmia svenssoni*** Tkalců, 1983 (n = 1, paratype)	***Osmia inermis*** (Zetterstedt,1838) (n = 10)
Swiss Alps (Ebenalp, Juf)	Northern Sweden (Abisko) (Tkalců, 1983).	Northern and central Europe, North America (Tkalců, 1983; Warncke, 1988).
Second mandibular tooth asymetrically triangular, separated from third tooth by acute-angled and broad indentation, from first tooth by shallow and rounded indentation (Fig. 1a).	Second mandibular tooth symmetrically triangular, broadly separated from both first and third tooth by acute-angled and broad indentation (Fig. 1b).	Second mandibular tooth broad and long, little prominent, not clearly separated from first tooth; indentation between second and third tooth very narrow, acute-angled (Fig. 1c).
Mandible at its inferior outer margin nearly straight, without tooth (Fig. 2a).	As in *Osmia steinmanni*.	Mandible at its inferior outer margin with prominent, asymmetrically triangular tooth (clearly visible only when mandible is opened) (Fig. 2b).
Ocelli less distantly separated from each other, distance between middle and lateral ocellus about two third of diameter of middle ocellus.	As in *Osmia steinmanni*.	Ocelli more distantly separated from each other, distance between middle and lateral ocellus about equal to diameter of middle ocellus.
Nervulus (cu-v) of fore wing postfurcal, i.e. running into cubital vein distally from orifice of basal vein.	As in *Osmia steinmanni*.	Nervulus (cu-v) of fore wing interstitial, i.e. running exactly into orifice of basal vein.
Tibial spine of middle leg longer, narrower and weakly bent (Fig. 3a).	As in *Osmia steinmanni*.	Tibial spine of middle leg shorter, broader and more triangular (Fig. 3b).
Pilosity of vertex, scutum, propodeum and first tergite whitish to yellowish-white.	Pilosity of vertex, scutum, propodeum and first tergite brightly yellowish-brown.	As in *Osmia svenssoni*.
Pilosity of scutum in its anterior four fifth whitish to yellowish-white with single intermixed blackish hairs, that of backmost part of scutum and of scutellum brightly yellowish-brown.	Pilosity of scutum and scutellum uniformly brightly-yellowish brown without blackish hairs.	As in *Osmia svenssoni*.
Pilosity of mesepisternum uniformly white to yellowish-white, in some specimens with single intermixed blackish hairs.	Pilosity of mesepisternum predominantly blackish, only on its most anterior and uppermost part on narrow zone brightly yellowish-brown.	Pilosity of mesepisternum in its upper part brightly yellowish-brown, in its lower part whitish.
Marginal zone of second and third tergite impressed on its whole width, clearly separated from disc.	Marginal zone of second and third tergite not impressed and not separated from disc.	Marginal zone of second and third tergite only slightly impressed, weakly separated from disc.
Punctation of tergite 2 mediobasally coarser, interspaces as large as the size of one to maximally two punctures.	Punctation of tergite 2 mediobasally finer, interspaces up to the size of three punctures.	As in *Osmia steinmanni*.
Punctation of central area of scutum just behind longitudinal suture more dispersed, interspaces up to the size of two to three punctures.	Punctation of central area of scutum just behind longitudinal suture denser, interspaces maximally as large as the size of one puncture.	As in *Osmia steinmanni*.
Longest hairs on outer margin of tibia of hind leg longer than maximal width of tibia.	Longest hairs on outer margin of tibia of hind leg as long as maximal width of tibia.	As in *Osmia svenssoni*.

Male

1 Outer margin of gonoforceps preapically with semicircular widening, gonoforceps here nearly twice as broad as at its narrowest width. Body length at least 11 mm.
Osmia alticola Benoist, 1922; *Osmia maritima* Friese, 1885; *Osmia xanthomelana* (Kirby, 1802). See Tkalců (1983) and Haeseler (1999) for distinctive characters.

1* Outer margin of gonoforceps preapically without widening or only weakly widened, gonoforceps here at most little broader than at its narrowest width. Body length at most 10 mm 2

2 Fourth sternite with normal hairs, without hooked bristles.
Osmia inermis (Zetterstedt, 1838); *Osmia hyperborea* Tkalců, 1983. See Tkalců (1983) and Haeseler (1999) for distinctive characters.

2* Fourth sternite with hooked bristles both along apical margin and on premarginal area; along apical margin the bristles are oriented horizontally whereas on the premarginal area they are directed increasingly vertically . . . 3

3 Underside of antennal segments only microscopically haired.
Osmia parietina Curtis, 1828; *Osmia uncinata* Gerstäcker, 1869. See Tkalců (1983) and Haeseler (1999) for distinctive characters.

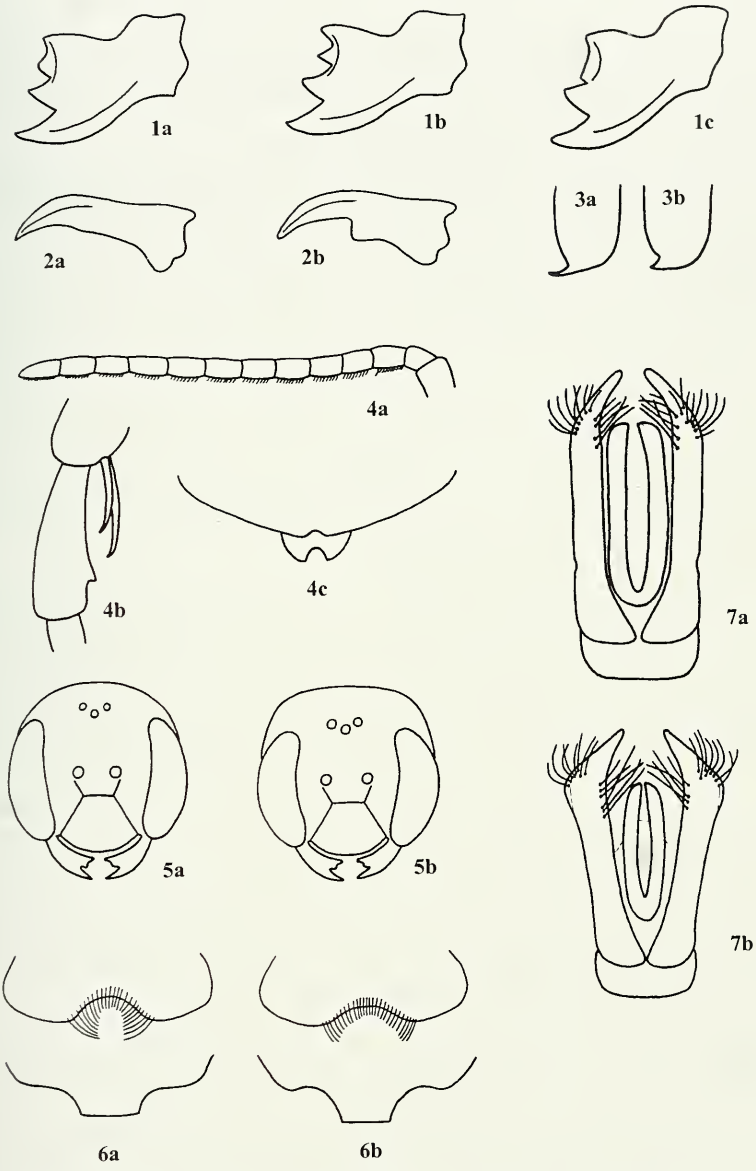
3* Underside of antennal segments with conspicuous bristles which are one fourth as long as diameter of antenna to as long as diameter of antenna 4

4 Bristles on underside of antennal segments as long as diameter of antenna. Projecting middle part of sixth sternite narrow, densely covered with conspicuously knobbed hairs.
Osmia pilicornis Smith, 1846.

4* Bristles on underside of antennal segments about one fourth as long as diameter of antenna. Projecting part of sixth sternite broad, without knobbed hairs.
Osmia svenssoni Tkalců, 1983; *Osmia steinmanni* sp. n.. See Tab. 2 for distinctive characters.

TABLE 2: Distinctive characters of ♂ of *Osmia steinmanni* sp. n. and *Osmia svenssoni* Tkalců, 1983.

Osmia steinmanni sp. n. (n = 2)	***Osmia svenssoni*** Tkalců, 1983 (n = 1, holotype)
Vertex (seen from the front) weakly ascending, outline of head roundish (Fig. 5a).	Vertex (seen from the front) more strongly ascending, outline of head more quadrangular (Fig. 5b).
Third sternite more deeply recessed, emargination about one third as deep as broad (Fig. 6a).	Third sternite less deeply recessed, emargination about one fifth as deep as broad (Fig. 6b).
Projecting middle part of sixth sternite shorter, less than half as long as broad (Fig. 6a).	Projecting middle part of sixth sternite longer, more than half as long as broad (Fig. 6b).
Outer margin of gonoforceps preapically not widened, gonoforceps here as broad as more basally (Fig. 7a).	Outer margin of gonoforceps preapically distinctly widened, gonoforceps here broader than more basally (Fig. 7b).
Marginal zone of second, third and fourth tergite strongly impressed on its whole width, polished to only superficially shagreened.	Marginal zone of second, third and fourth tergite weakly impressed, densely shagreened at least on its basal half.
Pilosity of second to fourth tergite yellowish-white.	Pilosity of second to fourth tergite brightly yellowish-brown.



FIGS 1-7

1: Right mandible of the ♀: a *Osmia steinmanni* sp. n., b *Osmia svenssoni* Tkalců, 1983, c *Osmia inermis* (Zetterstedt, 1838). - 2: Inferior outer margin of right mandible of the ♀: a *Osmia steinmanni* sp. n., b *Osmia inermis* (Zetterstedt, 1838). - 3: Tibial spine of right middle leg of the ♀: a *Osmia steinmanni* sp. n., b *Osmia inermis* (Zetterstedt, 1838). - 4: ♂ of *Osmia steinmanni* sp. n.: a Right antenna from the front, b Right basitarsus of hind leg, c Apical margin of sixth and seventh tergite. - 5: Head of the ♂ seen from the front: a *Osmia steinmanni* sp. n., b *Osmia svenssoni* Tkalců, 1983. - 6: Apical margin of third and sixth sternite of the ♂: a *Osmia steinmanni* sp. n., b *Osmia svenssoni* Tkalců, 1983. - 7: ♂ genitalia in dorsal view: a *Osmia steinmanni* sp. n., b *Osmia svenssoni* Tkalců, 1983.

Description

Female

Body length 8-10 mm, fore wing length 7.0 - 7.7 mm (Ø = 7.3 mm, n = 12). Body colour dark brown to black without metallic sheen.

Head: Head seen from the front about as long as broad. Distance between lateral ocellus and margin of vertex about three times as long as ocellar diameter. Mandible four-toothed; second tooth asymmetrically triangular, separated from third tooth by an acute-angled and broad indentation, from first tooth by a shallow and rounded indentation (similar to *O. uncinata*, see Tkalců, 1983) (Fig. 1a). Inferior outer margin of mandible nearly straight, without tooth (Fig. 2a). Punctation of vertex, genal area, supraantennal area, supraclypeal area and clypeus (apart from the polished marginal area) very dense, interspaces much smaller than the size of one puncture. Paraocular area less densely punctate, interspaces up to the size of one puncture. Pilosity of clypeus predominantly blackish with single intermixed white hairs, pilosity of the remaining head whitish to yellowish-white with many intermixed blackish hairs. Hairs on apical half of clypeus dense obstructing the view onto the polished marginal area of the clypeus (as in *O. inermis* and *O. svenssoni*).

Thorax: Punctation of scutum (except in centre), scutellum and mesepisternum very dense, interspaces much smaller than the size of one puncture. Central area of scutum just behind longitudinal suture more dispersely punctate, interspaces up to the size of two to three punctures. Metanotum, propodeal triangle and propodeum densely shagreened, dull. Pilosity of backmost part of scutum and of scutellum brightly yellowish-brown clearly contrasting with the remaining pilosity of the thorax which is whitish to yellowish-white. Scutum and in some specimens also mesepisternum with single intermixed blackish hairs. Veins and stigma of wings dark brown to black. Nervulus (cu-v) of fore wing running into cubital vein distally from orifice of basal vein ("postfurcal"). Tibial spine of fore and middle leg long, narrow and weakly bent (Fig. 3a). Tibial spurs of hind leg black. Erect pilosity of femur of all legs predominantly whitish with intermixed blackish hairs, that of tibia and tarsus predominantly blackish with intermixed white hairs. Longest hairs on outer margin of tibia and basitarsus of hind leg longer than maximal width of tibia and basitarsus respectively.

Abdomen: Declining basal portion of first tergite densely shagreened, only with silky lustre (as in *O. inermis* and *O. svenssoni*, see Tkalců, 1983). Punctation of disc of second to fourth tergite basally dense (interspaces mostly of about the size of one puncture), distally more dispersed (interspaces up to the size of three punctures). Interspaces on second tergite nearly polished, on third tergite superficially shagreened and on fourth tergite distinctly shagreened. Marginal zone of second and third tergite impressed on its whole width, clearly separated from disc, shagreened and dispersely punctate. Pilosity on first tergite whitish to yellowish-white, on second and third tergite yellowish-brown with many intermixed blackish hairs, on fourth and fifth tergite predominantly blackish with whitish hairs along the marginal zone. Sixth tergite covered with appressed white hairs. Longest hairs on second to fourth tergite about as long as the last three segments of the antenna, on first tergite sligthly longer. Abdominal scopa black.

Male

Body length 9 mm, fore wing length 6.7 - 7.0 mm (Ø = 6.85 mm, n = 2). Body colour dark brown to black; head, thorax and abdomen with faint blue green metallic sheen.

Head: Head seen from the front about as long as broad (Fig. 5a). Distance between lateral ocellus and margin of vertex about two and a half to three times as long as ocellar diameter. Underside of antennal segments each with 10-20 white bristles about one fourth as long as antennal diameter (as in *O. svenssoni*, see Tkalců, 1983) (Fig. 4a). Punctation of vertex, genal area and face (apart from the polished marginal area of clypeus) very dense, interspaces much smaller than the size of one puncture. Pilosity of head long and whitish, on clypeus, paraocular area and supraclypeal area very dense.

Thorax: Punctation of scutum, scutellum and mesepisternum very dense, interspaces much smaller than the size of one puncture. Metanotum, propodeal triangle and propodeum densely shagreened, dull. Pilosity of thorax whitish, on scutellum more yellowish but not as brightly yellowish-brown as in the ♀. Veins and stigma of wings dark brown to black. Nervulus (cu-v) of fore wing running into cubital vein distally from orifice of basal vein ("postfurcal"). Tibial spurs of hind leg black. Erect pilosity of all legs whitish. Basitarsus of hind leg toothed, with slightly diverging sides in its basal two third (parallel in *O. parietina*, see Tkalců, 1983) (Fig. 4b).

Abdomen: Declining basal portion of first tergite densely shagreened, only with silky lustre (as in *O. inermis* and *O. svenssoni*). Punctation of disc of second to fourth tergite very dense, interspaces up to the size of one puncture but mostly smaller. Marginal zone of second to fourth tergite strongly impressed on its whole width, polished to only superficially shagreened, nearly impunctate. Pilosity on first, fifth and sixth tergite whitish, on second to fourth tergite yellowish-white. Longest hairs on second to fourth tergite little shorter than the last two segments of the antenna, on first tergite distinctly longer. Apical margin of sixth tergite slightly notched in the middle, seventh tergite bilobed (Fig. 4c). Apical margin of second sternite more or less rounded (slightly emarginate in *O. uncinata*, see Tkalců, 1983). Third sternite deeply recessed, the emargination about one third as deep as broad and densely beset with long yellowish hairs (Fig. 6a). Fourth sternite as in *O. svenssoni* (see Tkalců, 1983): apical margin straight to very shallowly emarginate, premarginal area black, strongly shagreened and completely dull with hardly visible punctures (in contrast to *O. parietina* and *O. uncinata* where the premarginal area is dark brown, less strongly shagreened and more shiny with more distinct punctures); apical margin and premarginal zone beset with long and hooked, conspicuously yellowish-red coloured bristles (lighter in *O. parietina* and *O. uncinata*); along apical margin the bristles are oriented horizontally whereas on the premarginal area they are directed increasingly vertically. Fifth sternite broadly but weakly emarginate. Projecting part of sixth sternite rectangular (more roundish in *O. parietina* and *O. uncinata*, see Tkalců, 1983), less than half as long as broad (Fig. 6a). Gonoforceps inflected in its apical part, preapically with a tuft of stiff and yellowish-red bristles both on the outer and the inner side (Fig. 7a); its outer margin preapically not widened (weakly widened in *O. parietina*, see Tkalců, 1983), gonoforceps

here as broad as more basally; proximal to the inflexion and seen from above sides of gonoforceps nearly parallel for some distance (diverging towards base in *O. uncinata*).

DISTRIBUTION, HABITAT AND FLOWER PREFERENCES

O. steinmanni is known only from two localities in eastern Switzerland: Ebenalp (Wasserauen, Appenzell Innerrhoden) and Stallerberg (Juf, Graubünden). With 1500 m and 2300 m above sea level these two localities are at the lower subalpine and the lower alpine zone respectively.

At the Ebenalp *O. steinmanni* was found on stony slopes exposed to the southeast. The vegetation cover varied between densely vegetated meadow-like areas to barely vegetated screes intermixed with groups of spruces. The most prominent plant in flower was *Hippocrepis comosa* (Fabaceae). Bee species accompanying *O. steinmanni* were *Andrena intermedia* Thomson, 1870, *Andrena semilaevis* Pérez, 1903, *Lasioglossum cupromicans* (Pérez, 1903), *Osmia inermis* (Zetterstedt, 1838), *Osmia xanthomelana* (Kirby, 1802), *Hoplitis tuberculata* (Nylander, 1848) and *Bombus monticola* Smith, 1849, all typical inhabitants of upper montane and subalpine regions.

The ♀♀ of *O. steinmanni* were observed at flowers of *H. comosa*. The microscopic analysis of the pollen loads of four ♀♀ collected in 2002 revealed that this plant species is an important pollen source. All loads contained pollen of *H. comosa*. In addition, *Lotus corniculatus* (Fabaceae) was recorded in all samples as well.

DISCUSSION

Owing to the detailed study of Tkalců (1983) and the supplemental work of Haeseler (1999) the subgenus *Melanosmia* is well known in Europe. The discovery of a new *Melanosmia* species in the well investigated central European bee fauna is a surprise. The only unclear *Melanosmia* species in Europe is *O. bulgarica* described by Friese (1922) based on a single ♀ from Macedonia. Warncke (1988) treats *O. bulgarica* as a subspecies of *O. inermis* and mentions its occurrence in Macedonia, Greece and Italy. The type specimen obviously got lost (Tkalců, 1983), but according to the original description *O. bulgarica* differs from all other European *Melanosmia* species, including *O. steinmanni*, by its lack of black hairs on head, thorax and abdomen. Tkalců (1983) mentions a *Melanosmia* ♀ from Gran Sasso (Abruzzo, Italy) which might be either conspecific with *O. bulgarica* or represent a new species. Its declining basal portion of the first tergite being polished and its mandible bearing a tooth on the inferior outer margin exclude the possibility that this Italian specimen and *O. steinmanni* belong to the same species.

Although all museum and private bee collections available in Switzerland were examined only three contained specimens of *O. steinmanni* indicating that this species is extremely rare. However, its early flight period falling in late May, June and probably early July in combination with its occurrence in subalpine and alpine areas might explain why this species was so rarely collected. Bee researchers collect bees at higher elevations preferably later in the season when the weather conditions are more favourable. Therefore, *O. steinmanni* is expected to occur not only at additional localities in eastern Switzerland but also at other places in the Swiss and probably Austrian alps.

Melanosmia is especially well represented in montaineous regions (Michener, 2000). Two central European species, *O. alticola* and *O. inermis*, are known to occur beyond the timber line, the latter mounting up to 2800 m (Haeseler, 1999; Schedl, 1982). *O. steinmanni* is a further *Melanosmia* species reaching the alpine zone.

Based on morphological characters of the ♀ (but not of the ♂), *O. inermis* and *O. steinmanni* seem to be closely related. Most noteworthy is that both species were recorded together in the same habitat on the same day at the Ebenalp. Similarly, *O. svenssoni*, the closest known relative of *O. steinmanni*, coexists with *O. inermis* in northern Sweden (Tkalců, 1983). Given this syntopic occurrence the question arises how *O. inermis* and *O. steinmanni* are ecologically separated in the Swiss Alps. The few data indicate that the flight period of *O. steinmanni* starts earlier than that of *O. inermis*. At the Ebenalp, two freshly emerged ♂♂ but no ♀♀ of *O. inermis* were found on 1st June 2002 whereas the only ♂ of *O. steinmanni* collected that same day was heavily worn. However, most ♀♀ of *O. steinmanni* recorded on this day were rather fresh indicating that there is an overlap rather than a clear separation in the flight periods of these two species. *O. inermis* is known to prefer flowers of *Hippocrepis*, *Lotus* and *Onobrychis* (all Fabaceae) for pollen collection (Westrich, 1990). The few pollen loads of *O. steinmanni* were found to consist of pollen from partly the same Fabaceae. Therefore, an ecological separation with respect to the preferred pollen sources seems rather improbable. The possibility exists that the two species differ in their nesting sites or nest architecture. *O. inermis* is known to build its brood cells with masticated leaves under stones (Priesner, 1981; Schedl, 1982; Else & Edwards, 1996; own observation). Unfortunately, nests of *O. steinmanni* have not yet been recorded leaving the possibility of differing nesting biologies an open question.

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